

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



1  
P6925B  
cop 2  
B. P. I.—127.

LIBRARY  
RECEIVED  
NOV 2 1908  
U. S. Department of Agriculture  
S. P. I. D.—42.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF PLANT INDUSTRY,

Seed and Plant Introduction and Distribution,

Washington, D. C.

---

DESCRIPTION OF VARIETIES OF TOBACCO AND  
CULTURAL DIRECTIONS TO ACCOMPANY  
SEED DISTRIBUTED IN 1904-1905.

---

The work done by the Bureau of Plant Industry in the Connecticut tobacco fields during the past two years has brought out so clearly the value of careful selection of seed stock that it was thought wise to rewrite the directions to accompany the tobacco seed sent out and to incorporate in these directions certain suggestions in regard to selection.

While the work already done has clearly shown that tobacco may be readily selected to any desired type of leaf form, the best type for all the different kinds of tobacco used in the United States remains to be determined, as well as in how far selection or crossing may affect the chemical or physical properties of the leaf, these properties being of far greater importance than leaf form in most of the American types.

As rapidly as those working out this problem shall be able to show the way, this Office proposes to grow and distribute seed of the best types.

A. J. PIETERS,  
*Botanist in Charge.*

Approved:

B. T. GALLOWAY,  
*Chief of Bureau.*

WASHINGTON, D. C., *October 31, 1904.*

## DISTRIBUTION OF TOBACCO SEED IN 1904-1905.

The introduction of valuable foreign varieties and improved native types of tobacco has increased the value and yield of this crop in many sections of the United States. The Havana variety of the Connecticut valley and the Florida Sumatra type are striking illustrations of the benefit which has resulted from such importations of seed. In every case where the foreign or improved native varieties have been successfully established in any region small areas have been grown until the strains have been adapted to local conditions of climate and soil and a uniform type secured by seed selection.

It has been definitely determined, through experiments conducted by the Bureau of Plant Industry, that the different types of tobacco can be greatly improved by careful selection of seed saved under bag from the best individual plants in the field, and by crossing the native varieties with valuable foreign strains. Inasmuch as a large quantity of seed is produced by each plant, it is possible by saving comparatively few plants to supply enough highly bred seed for a large area. It is desirable in every case where this tobacco seed is used that a small number of plants be grown the first year in order to test the desirability of the particular strain for the local conditions, and from this small field the grower can select the best individual plants for seed for his entire crop the succeeding year.

There is no general farm crop which responds so readily to selection and breeding as tobacco. The transmitting power of the individual parent plants is exceedingly strong and the progeny of the individual seed plants show remarkable uniformity when the seed is saved under bag according to the plan outlined in the following pages. It is extremely important that strains of tobacco be secured in different sections resistant to the root and wilt, and other fungous diseases and insect enemies which attack the tobacco crop. A careful inspection of the tobacco fields where such diseases occur usually shows plants which resist the attacks of the various



diseases to a greater or less degree. The seed of such plants should be saved under bag in order to secure resistant strains. Wherever possible, the Department will undertake to make selections of resistant types and furnish small quantities of this seed for distribution.

It is advisable for tobacco growers to secure and test new varieties in different sections and especially to secure hybrids of the native and imported strains. In order to secure these hybrids it is essential to grow a few plants of the desired imported variety in order to procure pollen for crossing. In no case should a large area of plants be grown from the first year's cross or from specially imported seed. One hundred plants of each type or variety will give a fair indication of the nature of the cross or importation, and will furnish a sufficient number of plants from which to select seed for the next year's crop. After the grower secures a uniform crop of the desired kind, it is possible for him to select sufficient seed for his future crops according to the directions given in this circular for saving seed.

## DESCRIPTION OF VARIETIES.

### CIGAR-WRAPPER TOBACCOS.

**Sumatra.**—Leaf light in weight and color. Length of leaf varies from 12 to 20 inches, width from 8 to 16 inches. Number of leaves on plant ranges from 16 to 30. Habit of growth of leaf erect. Plant grows very tall with comparatively long internodes. Seed originally introduced into the United States from the island of Sumatra. It is usually grown under shade and makes our best grade of domestic wrappers. Grown in Florida, southern Georgia and the Connecticut Valley. Used wholly for wrapper purposes and is not considered of any value for fillers. In the United States this variety is grown only under slat or cloth shade.

**Havana Seed.**—A long, narrow, smooth leaf, from 20 to 32 inches in length and from 10 to 13 inches in width. There are from 10 to 15 leaves on a plant. The leaves are of a very thin, fine texture and delicate flavor, set close together on the plant with very short internodes, and stand very erect. The variety was secured by selection of mutations in fields grown from Cuban seed in the Connecticut Valley. Grown in the Connecticut Valley, Wisconsin, Ohio, Pennsylvania, and New York. Used primarily for wrappers, but in some sections, as

in Wisconsin, grown for binders. The top leaves are frequently used for fillers in the inferior grades of domestic cigars.

**Broadleaf.**—Formerly known and generally recognized in the trade as Connecticut Seedleaf. Leaves from 24 to 36 inches in length, 12 to 22 inches in width, and from 8 to 16 leaves on a plant. Broad leaves, thin, elastic, silky, small fibers, sweet taste, light in color. Leaves set close together on plant and have a characteristic drooping appearance. The size of leaf varies in different sections, but it is generally long and broad. Grown in the Connecticut Valley, New Hampshire, New York, Pennsylvania, Ohio, Wisconsin, Minnesota, and to a slight extent in Indiana and Illinois. Used principally for binders, to some extent for wrappers, and a few of the lower grades as fillers for the inferior domestic cigars.

#### CIGAR-FILLER TOBACCOS.

**Cuban.**—Small leaf of fine texture when grown under shade for wrapper purposes, but when grown outside for fillers of heavy texture. In some sections of the United States this variety retains much of the aroma of the Cuban-grown tobacco. Plants are tall and produce a large number of suckers under ordinary conditions. Leaves are from 10 to 18 inches in length and from 6 to 14 inches in width, there being from 6 to 18 leaves on a plant. This variety is grown from seed imported from the island of Cuba, and when grown for filler purposes the seed is usually obtained from the Vuelta Abajo district. Grown in Florida, Texas, Ohio, and Connecticut. In the Connecticut Valley this variety is principally grown under shade for wrapper purposes, the poorer grades being used for fillers. In Florida and Texas it is grown without shade and produces one of our best grades of domestic fillers.

**Zimmer Spanish.**—Very similar to the Havana. Largely used for filler purposes and is our most popular domestic filler. Grown in the Miami Valley, Ohio, and in Wisconsin.

**Little Dutch.**—Very narrow leaf, thick and short. Resembles the Yara tobacco in flavor. Originally from seed imported from Holland. Grown in Ohio and to some extent in Pennsylvania; used mostly for fillers.

#### PIPE TOBACCOS.

**North Carolina Bright Yellow.**—The leaves are light and spongy, of rather thick texture, set close together on the stem, stand erect, but droop at the ends, with the tips often touching

the ground. This variety is modified from the old native types of tobacco grown in Maryland, Virginia, and North Carolina. In size the leaf resembles that of the Broadleaf variety. Leaves are usually long and pointed, with comparatively thick midrib and veins. Used for plug, cigarettes, and smoking tobacco. Grown in Maryland, Virginia, North Carolina, and South Carolina.

**Maryland Tobacco.**—Leaves thick and coarse in texture, but light and chaffy when cured. Have erect position, drooping over at the ends. Size of leaf from 20 to 36 inches in length and from 10 to 26 inches in width. From 8 to 22 leaves on the plant. This variety was discovered in Maryland when the first settlers came into the region. It is used for pipe smoking, most of it being exported to France, Germany, and Holland.

#### PLUG TOBACCOS.

**White Burley.**—Long, broad leaf, white in appearance while growing. Leaves coarse and flat, with points hanging down, often touching the ground. They are from 28 to 36 inches long, 16 to 24 inches wide, and from 10 to 18 leaves grow on one plant. This variety originated in Brown County, Ohio, from selection of seed plants in a field of the Red Burley variety. Used for plug fillers and wrappers, cigarettes, and to some extent for pipe smoking. Grown in Ohio, Kentucky, North Carolina, and eastern Tennessee.

**Orinoco and Yellow Mammoth.**—Short, broad leaf, the Yellow Mammoth having large leaves and very rapid habit of growth. Used for plug wrappers and fillers, and is stemmed for export trade. Grown in Tennessee and Virginia. The varieties are probably modifications of the native varieties grown in these districts.

**Virginia Types.**—Large, fine leaf, usually long and well proportioned, good color, slightly ruffled. Used for plug fillers and wrappers; grown largely in Virginia, North Carolina, Kentucky, Missouri, Tennessee, and Indiana.

#### DIRECTIONS FOR CULTURE.

##### SUMATRA TOBACCO (NORTHERN DISTRICTS).

The seed bed should be so located that it will get all the benefit possible from the sun during the early spring days and be protected from the cold north and northwest winds. The



framework of the seed bed is made of 2 by 12 inch boards, set in the ground from 3 to 4 inches. As a rule, 200 square feet of seed-bed room should be provided for every acre of tobacco. The best method of covering the seed bed is by means of glass, arranged in a sash about 3 feet wide by 6 feet long, which is laid over the top of the framework. In some cases heavy cheese cloth is substituted for the glass, but the temperature can not be regulated as well as with the glass cover and should not be used where glass can be secured. The usual width of the framework is 6 feet, outside measurement, one side being sunk 2 inches lower than the other, so that the sash will lie over the top in a slanting position.

When it is necessary to water the seed bed, the sashes are removed temporarily and, as soon as the watering is completed, are replaced in their original positions. If it becomes necessary to air or cool the beds, one or more sashes can be raised until the desired object is accomplished. The soil for the seed bed should be a light, sandy loam, as free from weed seed or other pests as possible. A successful method of heating the bed is by using horse manure. In this case the bed should be dug out 2 feet deep about a week before the time for sowing the seed. The fresh horse manure should be packed in this space to a depth of  $1\frac{1}{2}$  feet and covered with 6 inches of soil. In many cases hot water or steam pipes are laid around the sides of the seed bed or under the surface of the soil in order to heat the beds. General experience has proved, however, that the manure beds are equal in value, if not superior, to the artificially heated ones.

The soil for the seed beds should be fertilized with a highly nitrogenous fertilizer, the one most commonly used being cotton-seed meal. This fertilizer should be thoroughly worked into the soil. The soil should be most carefully handled, so that at the time of sowing it is in a fine, loose, and friable condition, with an even surface. As the tobacco seed is very small it is necessary to have the soil in the finest possible tilth in order to present a uniform condition for the seed. During the growth of the young plants it is well to sprinkle over the beds a light dressing of nitrate of soda dissolved in water, after which it is washed into the soil by a light and fine spray of water. It is sometimes advisable to add a light application of phosphorus, in the form of ground bone, and of carbonate of potash, if the soil is deficient in these elements of plant food.



It is the usual practice in the North to sprout half of the seed used for the seed bed in moist, but not too wet, apple-tree punk or rotted cocoanut fiber about one week before the time for sowing the bed. The seed is thoroughly mixed with the punk and placed in a glass jar, which should be kept in a warm room. The seed will sprout quickly in this medium, and it is probable that earlier plants can be secured from such sprouted seed than from sowing the dry seed alone. The sprouted seed should be sown about the time the sprouts are from one-eighth to one-fourth inch in length or less. If the sprouts become too large, they will be injured during the process of sowing. Many growers sow the sprouted seed as soon as the seed coats burst and the sprouts appear. An equal amount of dry seed should be mixed with the sprouted seed when the beds are ready for sowing. In order to get an even distribution of seed over the seed bed it is well to mix the dry and sprouted seed with land plaster or gypsum, or, if this is not obtainable, corn meal, so that the seed can be sowed evenly over the bed. One tablespoonful of sprouted seed should be used for every 200 square feet of seed-bed surface.

After sowing the seed it is desirable to pack the surface carefully with a roller or heavy plank, in order to press the soil closely about the seed. If it is not desirable to pack the soil, the seed should be covered by lightly raking the surface with an ordinary garden rake. This method is preferred by many experienced growers. It has been found that light seeds are undesirable and in every case they should be separated from the heavy seeds and discarded. In order to make a thorough and complete separation it is necessary to use some form of wind-blast machine or modified fanning mill, which will blow out the light seed. If such arrangement is not to be had, the seed should be screened, after which the light seed which remains with the larger seed may be partially blown out by the ordinary current of wind by dropping the seed 2 or 3 feet in an open space. The heavy seed produces the strongest and most vigorous plants and is the most desirable for use in the case of all varieties of tobacco. The Sumatra seed grown in the North is usually sown in the seed bed from the 1st to the 20th of April and the plants are ready for transplanting from May 15 to June 10.

One of the most important points in raising a successful crop of tobacco is the care of the seed bed. It is necessary to water it frequently, usually once or twice every day during the early stages of growth. If the beds are artificially heated, warm water should be used for watering purposes, as the cold

water cools the beds and checks the growth of the young plants. The surface of the seed bed should not be allowed to become dry, as a few hours of dry seed bed are sufficient to kill all the young plants. The water should be applied in the form of a light spray, in order not to disturb the seed or the young plants in the bed, nor to pack the soil so that in drying it will cake and injure the plants. The temperature of the bed should be carefully regulated and in no case allowed to rise above 100° F. during the day or fall below 70° F. at night. If it is possible to maintain an even temperature, the plants will make the most rapid growth, but it is a question whether they will be as hardy as when subjected to the fluctuating temperatures corresponding to the natural changes between day and night. The bed can be cooled by removing the sash or watering during the day, if the temperature rises, and the temperature can be raised at night by using lighted lanterns set 5 or 6 feet apart in the seed bed, and the sash covered with a heavy cloth, such as an ordinary blanket, in order to retain the heat.

After the young plants reach the proper size for setting out, usually from five to six weeks after sowing in the seed bed, the sash can be taken off most of the time and the bed watered occasionally when the plants begin to wilt. If the plants come up too thick in any portion of the seed bed, it is necessary to thin them out. This can be done most easily by using an ordinary garden rake and pulling it carefully through the thickly set plants. Sufficient plants will be removed in this way, and those which remain will not be injured by the thinning process but will be benefited by the stirring of the soil. It is also desirable to keep out all weeds, carefully pulling them as soon as they appear among the tobacco plants. Before pulling out the weeds, the bed should be thoroughly watered and the weeds removed and carried to a safe place; otherwise they will probably sprout again. If the flea-beetle or other biting or eating insect attacks the young plants in the seed bed they should be sprayed with Paris-green mixture, at the rate of 1 pound to 100 gallons of water. If fungous diseases begin to grow in any portion of the seed bed it should be thoroughly aired by raising the sash during the day, the affected plants and soil should be removed and a light application of lime dusted over the beds.

The land used for setting the plants should be plowed in the autumn and, if possible, a cover crop used, such as vetch or some other legume. If such crops can not be secured, a crop

of rye may be grown with advantage to the soil. In the spring the land should be replowed and the cover crop thoroughly plowed under, together with an application of well-rotted stable manure at the rate of from 12 to 15 tons per acre. In addition to the stable manure it has been found that the following or similar fertilizers should be used in order to secure the best results: One ton of cotton-seed meal, 200 pounds of carbonate of potash, 500 pounds of starter, and 1 barrel of lime per acre. This fertilizer should be worked into the soil by a thorough stirring before the young plants are transplanted into the field.

When produced for wrapper purposes this variety is usually grown under shade, the special tent cloth for this purpose being most commonly used in the North. The purpose of the cloth shade is to protect the crop from hail, insects, and other dangers, and by reason of reducing the light secure a thin leaf. The effect of shade is also shown in influencing the humidity of the atmosphere and the temperature. The plants under shade show a much more upright habit of growth than the outside tobacco, and the leaves are finer, very thin and elastic, and with very small veins. Such a condition is desired by manufacturers for wrapper tobacco, but careful experiments should be conducted for several years in any region before the shade practice is introduced, in order to show whether the expense will be justified by the increased value of the crop.

In transplanting the young plants from the seed bed to the field it is desirable to make a selection of the best and most vigorous plants in the seed bed. At this early stage of growth the most vigorous plants having the best shaped leaves can be very easily distinguished by the grower and selected for the field. The ordinary distances for Sumatra plants is 3 feet 3 inches apart for the rows, and the plants should be set 12 inches apart in the row. In removing the young plants from the seed bed the bed should be thoroughly watered down and the plants taken out with all possible care, so that all the fine soil that adheres to the roots will be removed with them, all lumps or clods being shaken from the roots. In setting the plants in the field, care should be taken to have them straight, not bending the taproot, and to give the necessary application of water.

The cultivation of the crop should include the removal of all weeds from the field, particularly during the early stages of growth, and the production of a light, loose mulch on the surface of the soil. It is usually the custom to hoe the young

plants twice and to use a cultivator once a week during the remainder of the season until the plants become too large for cultivation. It is not necessary to ridge the soil along the rows during the latter part of the season, as level cultivation has been thoroughly demonstrated to give the best results in yield and in the general condition of the plants.

When the plants begin to bud, all except the individual plants saved for seed purposes should be topped. No universal or very definite rule can be given for this process, but it is the usual custom to break the top of the plant off just below the first seed sucker. As a rule the height of suckering must be governed by the local conditions, the soil fertility, and the season. In most cases two or three of the top leaves are removed by topping.

It is necessary to remove the suckers before they reach sufficient size to seriously injure or dwarf the plant or interfere in the development of the leaves. In most cases it will be found necessary to remove the suckers two or three times during the season in order to keep the plants free from these injurious branches. If seed is to be saved on any of the plants, the flower cluster should be covered with a light and strong bag before any of the flowers blossom out, in order to prevent cross-fertilization. The bags should be kept in good condition and not allowed to injure the top of the plant in any way. They should remain over the flowers until the seed pods are ripe and ready for harvesting.

The time for harvesting will depend to a considerable extent upon the season, but the ripeness of the leaves can be distinguished by the development of irregular, light, yellowish-colored patches over the surface and a thickening and crumpling of the body of the leaves. The leaves should be harvested before they become overripe, and it is the usual practice to pick them at three different times, the lower leaves maturing first, the middle leaves next, and the top leaves last, generally allowing from six to eight days between each picking. After picking, the leaves are carried to the curing shed in baskets made for this purpose and are strung on 4-foot laths especially arranged for them, at the rate of about forty leaves per lath. The leaves are arranged back to back and face to face and are regularly strung on the cord attached to the lath. The laths are then hung in the curing shed, where the leaves are allowed to thoroughly cure out.

When the tobacco is primed from the stalk, it should not take more than three weeks to cure; when it is hung on the stalks,



from four to six weeks are necessary. The manipulation of the barn, or curing shed, is governed entirely by the condition of the weather and the nature of the tobacco, so no fixed rules can be given. However, in a general way it can be said that if a barn is filled with green tobacco and the weather is hot and dry, the ventilators should be tightly closed for about three days, by which time the tobacco should begin to yellow. The barn should then be opened at night and kept closed during the day. This is done to prevent rapid curing, which destroys the life of the leaf and gives uneven colors. If there are frequent showers and but little sunshine, the barn should be kept closed and fires started in small charcoal heaters distributed throughout the barn. These fires should be continued as long as it is necessary to keep the tobacco in proper condition. Where charcoal heaters are not available, wood which has as little odor and as little smoke as possible should be used. It is very important to dry out the barn without giving the tobacco any foreign odors. To obtain the best results the tobacco should become fairly moist and fairly dried out once in every twenty-four hours.

When the midribs are thoroughly cured, the leaves are ready to be taken to the packing house. To get the tobacco in condition to handle, all the ventilators should be left open for one night, opening them about 6 o'clock in the evening. The next morning the tobacco should be in what is called "good case;" that is, it will have taken up sufficient moisture to make it soft and pliable. The barn is then tightly closed in order to retain the moisture, and the leaves are taken from the laths. The bottom, middle, and top leaves should be kept separate in the barn. After the tobacco has been taken down and packed, it should be taken at once to the warehouse for fermentation and baling.

The fermentation of the tobacco is to be done in bulk, and this sweating process must be watched with unusual care in order to prevent disaster to the crop. It is necessary to turn the bulk several times during the process of fermentation, in order to keep the temperature at the desired point. The object of turning the bulk is to reverse its construction, thereby bringing the top, bottom, and outside layers into the middle of the new bulk. This plan will permit a uniform fermentation of all the tobacco in the bulk. A convenient and practical size of bulk contains from 3,000 to 4,000 pounds and is 12 feet long and 5 feet wide. The temperature of the center of the bulk should in no case be allowed to rise above 120° F., and

after the temperature falls 6 to 8 degrees the bulk should be turned. The desirable maximum temperature is 115° F. It takes usually from six to eight weeks to complete the process of fermentation. After fermentation the tobacco must be sized, sorted according to the different market grades, tied up in hands, and baled or packed in cases.

#### CUBAN TOBACCO (NORTHERN DISTRICTS).

The arrangement of the seed bed, its treatment, and the transplanting, care, and cultivation of the Cuban variety in the North should be similar to the directions given for the Sumatra variety. There are no important differences in the treatment of these two varieties of tobacco under similar conditions until the process of preparing for market is reached. The Cuban variety is put up in a different style of package, corresponding to the old and established method which is followed by the tobacco growers in the island of Cuba. If imported Cuban seed be used, it is a good plan to sow an extra quantity, as the vitality of the seed imported from Cuba is usually very low, and it is generally necessary to sow additional seed in order to secure an even stand of plants in the seed bed.

All seed, and especially Cuban seed, should be tested for the condition of vitality before it is used for planting. This test can be made during the winter in a warm living room which is kept at a fairly regular temperature. A simple plan is to cut out sheets of ordinary blotting paper 5 inches square. These sheets should be thoroughly moistened with warm water just before using for this test. Two sets, representing the average sample of the entire number of 400 seeds, should be counted out and used for the test. This seed should be spread evenly over the surface of the moist blotting paper and loosely covered with a second sheet of this paper. If the paper is thin, two or more sheets should be placed together, the better to retain the moisture. The sheets should then be placed in an ordinary dish or vessel of some sort which can be covered over, in order to prevent the too rapid evaporation of moisture from the blotting paper. The condition of the seed should be examined at the end of six days and the sprouted seed counted and removed. The seed should then be allowed to remain between the blotting papers for eight days more, when the total number of sprouted seed can be counted and the percentage of vital seed determined. If the seed

shows a small percentage of germination and if it sprouts slowly, indicating weakened vitality, it should not be used, and other seed should be secured for sowing the bed.

#### CONNECTICUT HAVANA TOBACCO.

The seed bed for the Havana variety should be arranged similar to that for the Sumatra tobacco in the northern districts. However, the most common practice among the growers of this variety is to select a desirable piece of ground in a sheltered location and plow the land in the autumn. In most cases a nitrogenous manure, such as cotton-seed meal, is added at this time and allowed to remain in the seed bed over winter. In the spring, as soon as the soil has thawed out, it is replowed or turned with a spade, and a small amount of fertilizer, usually a phosphate, is sown broadcast over the surface. The bed is then thoroughly pulverized with a rake. The seed is usually sowed about the middle of April. The amount of seed used varies from 2 to 3 tablespoonfuls for every 200 square feet of seed bed. One-half of this quantity is usually sprouted in apple-tree punk and after sprouting mixed with the dry seed and sowed with land plaster or corn meal. The seed is usually lightly covered with soil by carefully raking the surface of the bed, leaving it smooth and level. These open beds are then usually inclosed or covered with cloth, and, during the cold nights early in the season, lanterns are placed under the cloth to prevent danger from frost.

The soil best adapted for the Connecticut Havana is a light, sandy loam. This land should be protected during the winter by a cover crop, such as rye, vetch, clover, or some other practicable crop. It is the usual custom to plow the land in the fall before sowing this cover crop. In the spring the land is replowed after an application of from 10 to 12 tons of barnyard manure per acre. In addition to the barnyard manure, cotton-seed meal at the rate of 1,000 pounds or more to the acre, 200 pounds of carbonate of soda, 500 pounds of starter, and a barrel of lime per acre should be added to the soil and thoroughly worked in with a disk or some other kind of cultivator.

The rows should be about 3 feet 3 inches apart and the plants set 16 inches apart in the row. All weeds should be removed and a loose mulch preserved by frequent cultivation during the growing season.

The plants are topped below the first large sucker, leaving from twelve to sixteen leaves to the plant. The average yield of this crop is from 1,500 to 2,000 pounds per acre.

The crop is harvested by cutting the plants at the proper time below the first pair of leaves, after the dew or other moisture has been thoroughly dried off the leaves by the sun and wind. The plants are laid down by the side of the row where cut until slightly wilted, but care must be taken during the hot, sunny days in order to prevent the leaves from being injured by the sun. As soon as they are wilted sufficiently, the plants are speared on a lath, usually allowing five or six plants to each lath. After the plants are arranged on the lath they should be taken to the shed in a wagon built for this purpose and so constructed as to prevent injury to the leaves during the transportation. The laths are then hung up in the curing shed and the plants allowed to dry out thoroughly and cure under careful supervision. While the leaves are still green, the barn is closed at night and during moist weather and opened during the day, in order to allow the rapid drying out of the leaves and stems. After the plants are practically dried, the barn is closed during the day and opened during the night as well as in damp weather. This curing process usually takes from five to eight weeks.

After the tobacco has been thoroughly cured, it is packed in cases and removed to the warehouse, where it is sorted into the different grades and prepared for the manufacturer.

#### CONNECTICUT BROADLEAF TOBACCO.

The methods of sowing the seed, preparing the seed beds, and handling the young plants of the Broadleaf variety, as well as the quantity of seed sown, are practically the same as in the case of Connecticut Havana. The land is usually fertilized with barnyard manure at the rate of from 8 to 12 tons per acre and tobacco stems at the rate of from 500 to 600 pounds to the acre, with little or no commercial fertilizer. Most crops of Broadleaf tobacco are grown by the aid of barnyard manure alone, but in recent years some of the growers have begun to apply cotton-seed meal, carbonate of potash, and tobacco starter at the same rate as that used for the Havana variety.

On setting out the plants of the Broadleaf variety the rows should be arranged 4 feet apart, and the plants from 22 to 24 inches apart in the row. The cultivation of the crop is similar to that for Havana tobacco. There is an unusual abundance



of suckers produced on most strains of this variety, and it is necessary to remove the suckers several times during most seasons. The methods of harvesting, curing, and arranging this tobacco for market are similar to those followed for the Havana variety.

#### WHITE BURLEY TOBACCO.

The seed bed should have a slightly southern exposure in order to get the benefit of the warm rays of the sun in the early spring, and the beds should be protected from cold winds. The best soil for the White Burley tobacco is a rich, friable, virgin loam or sandy soil. The best plan is to burn and prepare the seed bed on old sod lands. Many farmers select a spot in a vegetable garden and cover it with virgin mold taken from the woods and sow it, after thoroughly burning the land until it has a reddish or bricklike appearance, when it should be spaded up and thoroughly chopped over with hoes until it is fine and even. The ashes should not be raked off, but should be thoroughly mixed in with the soil. As soon as the ground can be worked in the spring, it should be lightly spaded and thoroughly loosened to a depth of 2 or 3 inches with harrows or hand rakes. When in good condition it should be marked off in beds about 4 or 5 feet wide and seeded. It is the usual custom in this variety to use a heaping tablespoonful of seed for every 100 square yards of seed bed. After sowing, the best plan is to run a heavy hand roller over the bed or press it with a board or with the feet. As a rule, the bed is tramped over with the feet until the surface is packed. The seed bed is usually protected by a canvas covering to prevent the ravages of the flea-beetle and to keep the bed moist and warm.

The preparation of the land is begun in the winter, generally in March, the usual plan being to turn under the soil with a two-horse plow to a depth of about 8 inches. About the middle of April a revolving disk or harrow is run over the land in order to cut the sod to pieces, after which the field is smoothed over with a slab drag. It is very rare for fertilizers or manure of any kind to be used in the White Burley districts. Tobacco stalks and trash from the barnyard are preferred to any other fertilizer for this tobacco. Owing to the fact that the crop is grown for two years and the field is then put in rotation with other crops the fertility of the soil is maintained.

The tobacco plants are usually set after a shower or, when there is no rain, they are set out in the afternoon. The land

is cultivated with a bull-tongue cultivator during the first week or so and then cultivated every week with a double-shovel cultivator as long as it is possible to do so without injury to the plants. As soon as the cultivation is finished the plants are topped, leaving from sixteen to twenty leaves on each plant. From four to five weeks after topping, the tobacco is usually fully ripe and the plants are cut with a tobacco cutter or butcher knife. The stalks are split down the middle and strung on sticks  $4\frac{1}{2}$  feet in length, after which they are taken to the tobacco barn and hung 12 inches apart on the tier poles. When fully cured the tobacco is sorted, usually into six grades, and the different grades are tied into bundles of from ten to twenty leaves and packed for the market.

#### SUMATRA TOBACCO (SOUTHERN DISTRICTS).

The location selected for the seed bed should have a slightly southern exposure, in order to get the full benefit of the warm rays of the sun in the early spring. The slope should be sufficient to insure perfect drainage at all times. It is desirable that the seed bed be surrounded by board walls, and covered with regular tobacco tenting cloth in the same manner that the plants are covered in the field. The cover will protect the tender plants from the cold north winds, and produce more uniform and favorable conditions, insuring early, rapid growth. This location should be permanent and abundantly fertilized every spring, and kept free from weeds and grass at all times. The soil becomes better adapted to plant-bed purposes each succeeding year if this method is followed. The soil should be a rich, friable, sandy loam, and in no case should a wet or heavy type be selected for growing tobacco plants. Deep plowing or spading should be avoided in the preparation of the soil, the usual depth being four or five inches. The ground should be harrowed and stirred with hand rakes until thoroughly pulverized, and all roots, tufts, and clods of earth should be removed.

After this preparation a liberal application of fertilizer rich in nitrogen and potash should be evenly distributed over the bed. A fertilizer containing 10 per cent of ammonia, 8 per cent of available phosphoric acid, and 12 per cent of soluble potash is highly recommended. Chlorin in any form must be avoided. After applying this fertilizer the bed should be again thoroughly stirred and left very smooth, in which con-

dition it is ready for the seed. The seed should be sowed at the rate of 1 tablespoonful to 200 square feet of seed bed. It is impracticable to sow this seed alone. It should be thoroughly mixed with wood ashes, corn meal, or land plaster. In order to obtain a uniform stand of plants it is advisable to sow half of the seed lengthwise of the bed and the remainder crosswise.

The proper time for sowing the seed is from February 1 to March 1. Wherever practicable, the land should be prepared and the fertilizer applied from one to two weeks before sowing the seed. After sowing, a light roller should be run over the bed, or some other means should be used to get the soil in a firm, compact condition, in which state it will retain its moisture, thus giving more favorable conditions for the germination of seed and for the growth of the young plants. The necessity of properly caring for the seed bed can not be too strongly emphasized, since nothing is of more importance in obtaining a vigorous growth in the field than strong, healthy plants. They should be made to grow steadily and vigorously without being checked until ready for transplanting. In order to obtain this condition, strict and constant attention must be given to watering the bed, keeping down all weeds and grass, and preventing the ravages of insect pests. In some cases it is necessary to use an additional application of fertilizer in the way of a top dressing. The necessity for this is often indicated by the plants turning yellow. The fertilizer should be essentially of the same composition as the one previously used, and whenever possible should be applied in a liquid form. This method of application makes it necessary to wash the fertilizer thoroughly into the soil by means of an abundant spray, and thus avoid injury to the tender plants.

Whenever it is found that the plants are too thick in the bed, it is advisable to thin them out by drawing an ordinary rake across the bed, allowing it to sink to a depth of from one-half to three-fourths inch. This can be done without seriously injuring the remaining plants and is, in fact, of positive benefit to them. In all cases some system should be provided for watering the plant beds during spells of dry weather. Water should be applied in the form of a light spray. During the first two weeks of plant growth it is essential that the surface of the soil be kept comparatively moist at all times, for at this stage a few hours of hot sun after the soil has become dry will be sufficient to kill most of the plants. Where irriga-

tion is used in growing the general crop, a system of overhead application is highly recommended for the seed-bed tent.

As has been previously mentioned, great care must be taken to remove all weeds and grass that may appear among the young plants. In every case before undertaking the process of weeding the bed it is most important to water thoroughly. This will prevent any serious injury being done to the roots of the tobacco plants.

One of the most injurious insects to be guarded against in the cultivation of the seed bed is the flea-beetle. According to the recommendation of the Bureau of Entomology the injury to the plants by this insect may be prevented by the use of a light spray of Paris green. The mixture should be made at the rate of 1 pound of Paris green to 100 gallons of water, which should be kept constantly stirred when in use. The same remedy can be applied in the case of the hornworm where the seed bed is not inclosed or covered.

The plants should be ready for transplanting in sixty or seventy days from the date of sowing the bed. Transplanting in Florida is usually done by hand, but wherever it has been tried the modern tobacco-setting machine has given very satisfactory results. The tobacco is usually set in rows 3 feet 3 inches apart and from 12 to 14 inches apart in the row, varying with the manner of shading. The plants can be set much closer together where cloth is used than under the slat shade. The fertilization is essentially the same as that used in the northern districts, except in the case of stable manure, cow manure being highly preferable in the Florida tobacco fields. Although conducted in very much the same way, the cultivation is continued much later in the season than in the northern districts, especially when rains are not abundant. In the dry season it is a common practice among growers to cultivate frequently until the second or third primings have been made. Subsoiling before transplanting the tobacco has proved a very effective means of retaining the soil moisture.

The processes of topping, suckering, harvesting, and curing, together with fermenting, are essentially the same as those employed in the northern districts.

#### MARYLAND TOBACCO.

The seed bed should be located on a dark, friable, loamy soil with a southern exposure. The plants may be easily watered if the seed bed be located near a brook. The old method of



burning the seed bed has been largely abandoned, but, if used, care should be taken to burn only small timber and brush. A large quantity of ashes is detrimental to the growth of the young plants. All trees within 30 feet of the seed bed should be cut down and piled on the north and west sides for a partial protection against the cold winds. The proper time for preparing and sowing the seed bed is from February 1 to March 15. The bed should be spaded to a depth of 4 or 5 inches and all roots and tufts carefully removed. The soil must be thoroughly pulverized with garden hoes, hand rakes, or other suitable implements. Before the last stirring an application of a highly nitrogenous fertilizer should be evenly distributed over the bed and thoroughly incorporated into the soil. A mixture of 50 pounds of nitrate of soda, 40 pounds of fine-ground bone, and 10 pounds of carbonate of potash applied at the rate of 15 pounds per square rod is highly recommended. Sow the seed at the rate of two tablespoonfuls to the square rod. It can best be uniformly distributed over the bed by mixing with wood ashes or land plaster, dividing it into two equal parts, and sowing half of it over the bed crosswise and the other half lengthwise. The sides of the bed should be from 8 to 10 inches high and wires should be stretched across it 3 feet apart. The beds can be covered with light cheese cloth or tobacco-bed cloth after the seed has been sowed. The covering serves as a complete protection against the ravages of the flea-beetle and other insects provided there are no open spaces around the bed. All weeds and grass should be removed. It is seldom necessary to water the plant beds, except in the case of unusually dry weather. Water at this time is very essential. It should be applied as in the northern seed beds, but less frequently, it being seldom necessary to water the beds more than twice a week.

In most cases it is advisable to replenish the plant food with a top dressing or fertilizer of the same composition as that of the first application. This should be applied in liquid form wherever it is possible to wash it in thoroughly, otherwise it is most important to top-dress the beds only during the hot, dry days. The top dressing should be used when the plants are from 2 to 3 inches high. Where cloth is not used for covering, the beds must be closely guarded against the attacks of the flea-beetle. When this insect first makes its appearance the plants should be treated with Paris green at the rate of 1 pound to 30 pounds of land plaster. The cloth covering should be removed from the beds at least

a week before transplanting, to prevent the injurious effect of the radical change from the seed bed to the open field.

Maryland tobacco is transplanted from May 15 to June 15. Care must be used to wet the seed bed down thoroughly before drawing the plants, thus protecting the roots from injury. The mottled or mosaic tobacco, so common in Maryland tobacco fields, is frequently due to the practice of drawing the plants when the soil is not thoroughly moistened. This variety should be set in the field in rows  $3\frac{1}{2}$  feet apart and the plants 30 inches apart in the row.

Tobacco should be preceded by a leguminous crop of some kind, hairy vetch being highly recommended for this purpose. In addition to the nitrogen from the leguminous crop, a fertilizer rich in potash and containing a moderate amount of phosphoric acid should be added before transplanting. The best stand is obtained in the field where the land has been plowed deeply and harrowed several times, thus leaving a thoroughly pulverized soil for the reception of the plants. The methods of cultivation, topping, suckering, and harvesting are essentially the same as in the case of the Connecticut Havana seed.

#### NORTH CAROLINA BRIGHT YELLOW AND VIRGINIA TOBACCOS.

The methods of sowing the seed and of preparing and caring for the seed bed are the same as those used by the Maryland growers. The seed, however, may be sown at least a month earlier than in Maryland.

Two systems of harvesting are in general use, both of them having certain advantages. The more common system is to prime the leaves as fast as they ripen and string them on laths, allowing thirty to thirty-two leaves to a lath. The other system is to cut the entire stalk and cure the leaves on it, as is done with the Havana variety. It is usually flue-cured or fire-cured, for which purpose a special type of barn is used. The essential points of this barn are that it should be practically air-tight and provided with one or two furnaces having flues leading up through the center of the barn, giving a large heating surface. There should be at least two small ventilators on or near the top of the barn.

As soon as the barn is filled with tobacco, fires should be started and the temperature raised to 90° F., where it should remain from twenty-four to thirty hours, during which time the tobacco becomes a uniformly bright yellow color. The next

step in curing is to raise the temperature from 90° to 120° F. during fifteen to twenty hours. This process is commonly known as "fixing the color." Then the temperature may be raised gradually to 125° F., at which point it should be maintained for about forty-eight hours. By this time the leaves should be almost, if not entirely, yellow, but the stalk still green. In order to cure out the stalk the temperature can be raised to 175° F. at the rate of 5 degrees an hour, where it should remain until the stalks are thoroughly dried. Great care must be taken during the entire process of curing not to allow the temperature to fall, for a lowering of the temperature invariably produces discolorations in some parts of the leaf.

#### ZIMMER SPANISH TOBACCO.

The preparation and care of the seed bed for this variety should be the same as for Connecticut Havana. The rows of plants in the field should be 3 feet apart and the plants set 15 to 20 inches apart in the row. The plants should be topped so as to leave about sixteen leaves for each plant, the average yield being about 700 pounds per acre. The methods of cultivation, harvesting, and curing the Zimmer Spanish variety are essentially the same as those which are given for the Connecticut Havana tobacco.

#### CUBAN TOBACCO (SOUTHERN DISTRICTS).

This variety is grown without shade when used as a filler for domestic cigars. The percentage of wrappers in this outdoor crop is so small that the practice of sorting them out has been abandoned by most packers. The preparation and care of the seed beds and methods of cultivation are about the same as in the case of the Sumatra variety. The rows in the field are arranged 3 feet 4 inches apart and the plants set 14 inches apart in the row. A greater distance results in thick, heavy leaves. If the plants are set too close, the leaves are too thin and lacking in body for filler purposes.

No definite rule can be laid down as to the proper number of leaves to be left on the stalk when the plants are topped. This number varies with the height of the plant and the climatic conditions during the season. From fourteen to sixteen leaves, however, are considered desirable during the ordinary season. The suckers begin to appear very soon after topping and should be removed every eight or ten days, or once a week when rains are frequent.

Worms are usually very troublesome on this variety of tobacco and must be picked off and destroyed as soon as they appear, or they can be poisoned with a very light spray of Paris-green mixture. Use 1 pound of Paris green to 100 gallons of water, this being sufficiently strong to kill the hornworms without injuring the leaves. If a stronger solution is used there is danger of burning the leaves so that patches of green will appear after curing.

The manner of harvesting the southern Cuban tobacco is essentially the same as that practiced with the Connecticut Havana seed. The number of plants to the lath, however, may be increased to eight or ten where the growth is comparatively small. The old method of priming the Cuban tobacco has been almost entirely abandoned. There are no advantages in this system over the present method of cutting the plants so far as the production of a filler leaf is concerned.

Where the soil has been abundantly fertilized and the season is favorable, a profitable second crop of filler can be grown, which is commonly called a "sucker crop." A week after cutting, all the suckers should be broken off the old stump with the exception of one, which is to be allowed to remain and mature. It should be handled in exactly the same way as the original crop. The sucker crop ordinarily produces about one-half the yield of the main crop. It is profitable because no extra fertilizer is used and the cost of production in general is very small.

### **DIRECTIONS FOR SAVING SEED.**

In all cases where new seed is taken into a locality, it should be thoroughly tested before it is used on a large scale. This is especially true of all seed imported from Cuba, Sumatra, Turkey, or any foreign country. The past few years have witnessed a striking illustration of the effect of using seed direct from tropical regions, such as Cuba and Sumatra, particularly in the northern tobacco districts. The plants grown from this freshly imported seed broke up into many different types, some of which may prove valuable, while most of the types are irregular and undesirable. Therefore, it has been a common experience for growers to suffer great losses by reason of the presence of these undesirable types during every season in which this seed was used. This breaking up of type is due to the change of climatic and soil conditions, which causes striking variation in the plants grown from the imported seed.



This variation is particularly marked where southern seed has been taken to northern tobacco districts.

Our experiments have shown that if the seeds from typical and desirable plants in these crops are saved under bag and thus protected from cross-fertilization, the plants produced from the seed will be uniformly like the parents. The second season it is a good plan to increase the area of plants grown from the seed saved under bag, and from the most desirable plants in this crop selections of seed can be made for future general crops. If the crop during the second season shows great uniformity of a desirable type, it is advisable to save a large amount of seed under bag; if possible, sufficient to plant several succeeding crops. Inasmuch as tobacco seed properly cared for will retain its vitality for from ten to twenty years, a number of crops can be raised from the seed saved from this desirable type.

The grower of all new varieties of seed should test them on a small area before using them for his entire crop. It has been found that some fungous diseases are transmitted in the seed which it is not possible to destroy by any known special treatment of the seed before planting. Therefore it is a wise plan to grow a small area of tobacco and to observe the plants carefully in respect to the presence of fungous or other diseases before using them in large fields. In other cases certain fungous diseases are present in the soil, which attack and destroy the varieties imported from other regions. In most cases resistant plants are found in fields affected by this disease. The structure or habit of growth of these resistant plants is such as to throw off these attacks. The seed from the resistant plants should be saved under bag and used for the next year's planting. In this way resistant strains of tobacco may be secured, which will prove to be immune to the attacks of the various diseases.

In selecting seed plants several important facts should be taken into consideration. All the plants in the field should be carefully studied and observations made on the shape of the leaf of the different plants, on the variations in size and color of leaves, and on the time of maturity of individual plants in the field. The number of leaves and the number of suckers should be counted on the different plants in order that an accurate idea may be gained of the extent of variation in the variety as regards these points. There is a great variation in all of the important characters which go to make up the type of plant, and individual plants will be found which have desir-

able shape, size, and color of leaf, of early maturity, and with an extra large number of leaves and few suckers. The grower should decide in his own mind on the type of plant which he desires to grow for his crop and should carefully select those plants in the field which most nearly fulfill this ideal.

The flower head on the selected seed plants should be inclosed with a light but strong paper bag just before the flowers begin to open. It is usually a good plan to remove two or three of the top leaves and suckers just below the flower head. The bag should be tied around the stem in such a way as not to interfere with the growth. It will be found that at this period of growth the plant increases in height very rapidly, and it will be necessary to raise the bag occasionally in order to prevent the flower head from pushing out at the bottom of the bag. For most varieties a 12-pound bag is the most desirable size. This bag should be of strong but light material. The ordinary paper bag found at any grocery store is satisfactory for this purpose. When the seed pods have turned brown the entire top of the plant should be cut off and the leaves removed. The bag should be opened and all of the small and late pods picked off and only the large, heavy, plump, and well-developed seed pods allowed to remain. The bag should then be replaced and the seed head hung up in a dry place, such as the attic of a house, until the seed pods are thoroughly dried. After this they should be cut off from the stem and the seed shelled out. After the seed has been secured, all of the light seed, hulls, and chaff should be removed by a fanning mill or by some form of air-blast machine adapted for this purpose, and only the heavy seed should be retained for planting. The heavy seed should then be placed in dry glass jars and set in a safe place. In this condition the seed will retain its vitality unimpaired for a long period.

In many cases it may be desired to cross an imported with a native variety. The object of such crosses is to secure the improved quality of the imported strains combined with the hardiness and yielding power of the native varieties. In the case of tobacco, such crosses are easily made by the grower. The tobacco plant has a perfectly self-fertile and complete flower, which is easily cross-fertilized. In order to prepare the flower for cross-fertilization the anthers should be removed from the selected flower shortly before they open and discharge their pollen. After an examination of a number of flowers in the field the grower can easily observe the proper time to re-

move the anthers so that none of the pollen shall have escaped and fertilized the flower. One easy means of noting this time is to observe the condition of the corolla. The anthers should be removed just before the corolla opens out. As soon as the anthers have been removed a small paper bag should be tied over the flower and allowed to remain for at least one day until the stigma becomes receptive for pollen. This receptive condition of the stigma is easily noted by the presence of a sticky, viscid substance over the surface. At the proper time for emasculation, anthers from the desired imported strain which are just ready to discharge their pollen should be secured. These anthers should be broken open and the pollen carefully rubbed over the surface of the stigma of the flower to be fertilized. As soon as this pollination has been completed, the small bag should be replaced over the flower and allowed to remain there until the end of the season. A small tag should be attached to the flower, giving the name of both parents, as Havana  $\times$  Sumatra, the first name referring to the female and the second to the male parent.

The best plan which can be followed in the case of crosses is to set out the next season 100 plants of each cross and carefully note the characteristics of the hybrid plants. It will be found that there will be considerable variation in the plants the first season. Seed should be saved from those plants which are most desirable and which show the greatest improvement over the native varieties. The next season a larger area can be planted from this seed, and if the crop is uniformly of the type desired enough seed can then be selected the second season to plant the entire crop the following year.

## DESCRIPTION OF PLATES.

PLATE I. Variation in type in Sumatra variety. This illustration shows two plants of the Sumatra variety grown in the Connecticut Valley from seed freshly imported from the island of Sumatra. The plant to the left was classed under the head of the Belgian type and the one to the right as belonging to the crumpled type of Sumatra. These two plants, growing side by side in the field, illustrate the striking variations in type induced by a radical change of soil and climatic conditions the first season. Seed from each of these types was saved under bag during the season of 1904, and the plants grown from this seed were set in individual rows in the field this season. In every case the plants came absolutely true to seed, the young plants being uniformly like the parents in all characters.

PLATE II. Variation in size of leaves. Two plants of the same type, growing side by side in the field, showing characteristic differences in size of leaf. The size of leaf is transmitted by seed uniformly throughout the entire crop when the seed is saved under bag.

PLATE III. Variation in shape of leaves in Sumatra types. The characteristic shape of leaf is transmitted absolutely by seed. In our experiments it has been found that where the seed from a plant having a characteristic shape of leaf was saved under bag, the plants grown from this seed the succeeding seasons produced uniformly the shape of leaf of the parents. It was found that it was possible to secure a very round or a very pointed leaf—in fact, any shape which was desired—by the selection of seed plants having leaves of the shape sought.



PLATE IV. Typical Sumatra plant of the smooth-leaf type. This plant is at the proper stage of maturity for bagging. When the flowers have reached this stage of maturity the bag must be placed over them promptly in order to prevent any possibility of cross-fertilization.

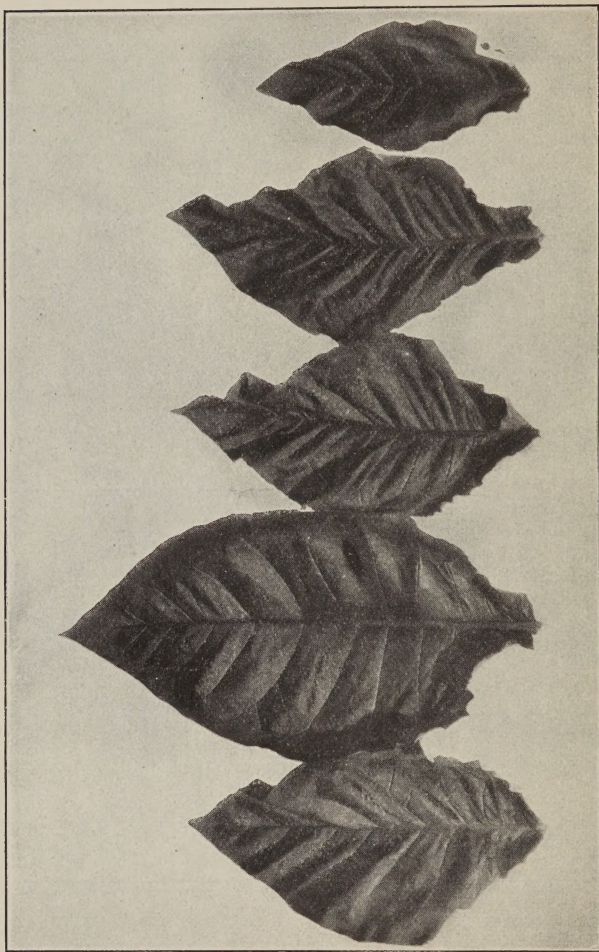
PLATE V. Typical Cuban plant grown under shade in the Connecticut Valley. This plant shows the method of arranging the bag over the flower head to prevent cross-fertilization. It has been conclusively shown in our experiments that seed produced under bag in this way is heavier, brighter in color, and freer from mold than seed saved without such protection. The ordinary strong manila bag which can be secured at any grocery store can be successfully used for this purpose. A convenient size of bag is 12 pounds. The upper leaves should be removed, together with the suckers, before the bag is applied, as shown in the photograph. During the growth of the plant the bag should be pushed up along the stem in order to prevent any injury to the flowers by pressing against the sides and bottom of the bag. In harvesting the seed plants the seed head should be cut off with three or four feet of stalk attached, the bag temporarily removed and all small or injured pods taken out and discarded. The bag should then be replaced and the entire head hung up in a dry attic until the seed is fully matured.



VARIATION IN TYPE IN SUMATRA TOBACCO.



VARIATION IN SIZE OF LEAVES



VARIATION IN SHAPE OF LEAVES IN SUMATRA TYPE.





TYPICAL SUMATRA PLANT OF THE SMOOTH-LEAF TYPE.



TYPICAL CUBAN PLANT, GROWN UNDER SHADE IN THE  
CONNECTICUT VALLEY.